Original Article

Imaging Characteristics of Focal Liver Lesions on Contrast-Enhanced Helical Computed Tomography

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Abstract

Introduction: The discovery of computed tomography (CT) by G.N. Hounsfield in 1972 has been a milestone in medical diagnostic imaging as cross-sectional imaging took a step into diagnostic radiology. The use of contrast agents for CT of the liver has been used since long back. However, the advent of multidetector helical CT has made the dream of multiphasic imaging a reality. This has led to imaging the liver during the various phases of enhancement and helping in characterization and detection of the lesions.

Material and methods: This prospective study was done in the Department of Radiodiagnosis and Imaging at Bhopal Medical Centre, Bhopal, Madhya Pradesh, India. A total of 100 patients who were referred to our department with strong clinical suspicion of focal liver lesion and those diagnosed by ultrasonography underwent multiphasic contrast-enhanced CT evaluation of abdomen using single-slice spiral CT scanner from March 2010 to May 2012.

Results: In our study, the majority of cases diagnosed were that of malignant lesions in 47% of cases. The other lesions diagnosed were benign lesions in 34% of cases and inflammatory lesions in 19% of cases. Among the malignant lesions, the most common diagnosis was that of metastases seen in 67% of cases. The next most common was hepatocellular carcinoma (HCC) seen in 29% of cases.

Discussion: Contrast-enhanced multiphasic CT plays an indispensable role in the detection and characterization of focal lesions of the liver. The aspects of the identified liver abnormalities influence the clinical and surgical decision-making. Benign abnormalities such as cysts and hemangioma do not require treatment, but some benign cases require treatment such as FNH and hepatocellular adenoma requires treatment in some cases. Malignant lesions arising from the liver such as HCC often need treatment. Metastases may or may not be amenable to treatment.

Conclusion: The accuracy of contrast-enhanced multiphasic CT in detecting and characterizing focal liver lesions is high, and it should be considered in the imaging workup of any patient with focal liver lesions. This helps in guiding further management of these patients avoiding unnecessary investigations and workup for the diagnosis as there is a high incidence of benign pathologies in the liver.

Key words: Benign, Contrast-enhanced helical computed tomography, Hepatic, Malignant

INTRODUCTION

Liver is the largest organ of the human body and being a filter in the body is plagued by a variety of focal and diffuse pathologies. As it is one of the most common locales for the spread of malignant diseases, the liver is the abdominal organ of greatest interest for imaging studies.

The discovery of computed tomography (CT) by G.N. Hounsfield in 1972 has been a milestone in medical diagnostic imaging as cross-sectional imaging took a step into diagnostic radiology. The use of contrast agents for CT of the liver has been used since long back. However, the advent of multidetector helical CT has made the dream of multiphasic imaging a reality. This has led to imaging the liver during the various phases of enhancement and helping in characterization and detection of the lesions.

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The increased speed of scanning, the absence of respiratory misregistration artifacts due to single breathhold scanning ability to reconstruct thin slices retrospectively, and multiplanar reconstruction capability in sagittal and coronal have made multiphasic scanning taking a giant leap in the characterization of focal liver lesions by non-invasive means.

Although the recent evolution of diagnostic radiologic technologies has changed the setting of hepatic imaging, misdiagnoses during early disease development may prevent patients from obtaining advantageous management. There is an insufficient diagnostic performance for both the early detection and the characterization of small liver lesions even with CT and magnetic resonance (MR) imaging techniques. As such, there is a need to improve on morphology-based CT and MR imaging using contrast agents for the early detection and characterization of hepatic disease.[1-3]

MATERIALS AND METHODS

This prospective study was done in the Department of Radiodiagnosis and Imaging at Bhopal Medical Centre, Bhopal, Madhya Pradesh, India. A total of 100 patients who were referred to our department with strong clinical suspicion of focal liver lesion and those diagnosed by ultrasonography underwent multiphasic contrast-enhanced CT evaluation of the abdomen using single-slice spiral CT scanner from March 2010 to May 2012.

Inclusion Criteria
The following criteria were included in the study:
- Patients referred to the Radiodiagnosis Department of Bhopal Medical Centre, Bhopal, with strong clinical suspicion of focal lesion of liver including those with primary malignancy elsewhere.
- Patients already diagnosed with focal liver lesion by ultrasonography.

Exclusion Criteria
The following criteria were excluded from the study:
- Patients with diffuse liver diseases.
- Patients with mass lesions infiltrating the liver from outside the liver.
- Patients with traumatic injury to liver.

Procedure
After obtaining the written consent from all the participants under the study, detailed history of the patient including signs and symptoms, detailed physical examination, biochemical investigations, and radiological investigations which included chest X-ray and ultrasonography of the abdomen were recorded.

The liver was viewed in non-contrast-enhanced phase, arterial phase, portal venous phase, and delayed phase in axial, sagittal, and coronal sections and any abnormality was identified. When multiple lesions are noted, the most representative lesion or the largest of the lesions was taken into consideration. When different types of lesions were identified in the same person, representative lesions of each type were considered. The following characteristics of the lesions were noted.
- The number of lesions.
- The segmental location of the lesion.
- The size and shape of the lesion.
- The presence of calcification/septa/internal nodules.
- The wall/thickness of wall/sharpness of contour
- Homogenous/heterogenous.
- Presence/absence of enhancement.
- Pattern of enhancement in arterial, portal venous, and delayed phases.
- Potency of vessels.
- Surrounding hepatic parenchyma.
- Other specific features.

Follow-up of all patients was done either with biopsy, aspiration, surgical correlation, follow-up ultrasonography to look for the stability of the lesion, or additional investigations like MRI/nuclear scintigraphy. The final diagnosis was made. Then, results obtained were compared with the multiphasic contrast-enhanced helical CT imaging findings and tabulated.

RESULTS

The present study was carried out in the Department of Radiodiagnosis, Bhopal Medical Centre, Bhopal, Madhya Pradesh.

A total of 100 patients were included which were referred to our department with a history of focal liver lesions. Contrast-enhanced multiphasic CT was performed and evaluated for the underlying focal liver lesion.

In our study, majority of patients belonged to the age group 30–39 years (29%) and males constituting 55% of cases. The most common clinical presentation was that of pain in abdomen seen in 57% of cases. The second most common presentation was that of the history of malignancy elsewhere seen in 36%.

The right lobe alone was involved in the majority of patients (40%) followed by bilateral lobe involvement in 39%. The majority of patients were found to have multiple lesions seen in 51% of cases.

In our study, the majority of cases diagnosed were that of malignant lesions in 47% of cases. The other lesions diagnosed were benign lesions in 34% of cases and inflammatory lesions in 19% of the cases.

Among the benign lesions, the most common diagnosis in our study was simple cyst seen in 53% of cases. The second most common diagnosis was that of hemangiomas seen in 35% of cases.

Among the malignant lesions, the most common diagnosis was that of metastases seen in 67% of cases. The next most common was hepatocellular carcinoma (HCC) seen in 29% of cases.

Among the inflammatory lesions, the most common diagnosis with liver abscess was seen in 58% of cases followed by hydatid cyst seen in 42% of cases [Table 1-4].

DISCUSSION

Table 1: Etiological distribution of cases

Type of lesions	Number of cases (%)
Benign	34 (34)
Malignant	47 (47)
Inflammatory	19 (19)
Total	100 (100)

Table 2: Distribution of benign lesions

Type of lesion	Number of cases (%)
Simple cyst	18 (53)
Hemangiomas	12 (35)
Focal nodular hyperplasia	1 (3)
Focal fat	2 (6)
IHE	1 (3)
Total	34 (100)

Table 3: Distribution of malignant lesions

Lesion	Number of cases (%)
HCC	14 (29)
Cholangiocarcinoma	1 (2)
Hepatoblastoma	1 (2)
Metastases	31 (67)
Total	47 (100)

HCC: Hepatocellular carcinoma

Table 4: Distribution of inflammatory lesions

Lesion	Number of cases (%)
Livers abscess	11 (58)
Hydatid cyst	8 (42)
Total	19 (100)

Contrast-enhanced multiphasic CT plays an indispensable role in the detection and characterization of focal lesions of the liver. The aspects of the identified liver abnormalities influence the clinical and surgical decision-making. Benign abnormalities such as cysts and hemangioma do not require treatment, but some benign cases require treatment such as FNH and hepatocellular adenoma requires treatment in some cases. Malignant lesions arising from the liver such as HCC often need treatment. Metastases may or may not be amenable to treatment.

In our study, majority of the patients were presented with unilateral involvement of the right lobe only in 40% of cases. This was followed by bilateral lobar involvement seen in 39% of cases. This is in concordance with the distribution of focal liver lesions more common on the right lobe as seen in the observations by Joseph et al.,[4] John et al.,[5] and Kamel et al.[1]

Among solid lesions, the most common enhancement pattern was that of hypo-hypo-hypo pattern seen in 34% of cases. This is due to the increased number of metastases cases. This is followed by the hyper-A-A pattern seen in 24.5% and arterial-arterial-arterial pattern in 19% of cases. This is similar in the incidence to the study conducted by van Leeuwen et al.[6] Other patterns of enhancement were seen in the lesser frequency of cases.

Hemangiomas were diagnosed by the presence of a hypodense lesion with peripheral nodular enhancement of arterial attenuation with centripetal fill in van Leeuwen et al.[6] and Murcio et al.[7] One case of hemangioma was wrongly diagnosed as HCC (false negative) due to the presence of a Hyper-A-A pattern of enhancement.

FNH was diagnosed as a hypo/isodense lesion with homogenous arterial enhancement and a hypodense central cleft corresponding to the scar Joseph et al.[4] and van Leeuwen et al.[6] One case was wrongly diagnosed as metastases (false negative), and it had Hyper-A-A pattern.

Focal fat was diagnosed by the presence of a hypo-hypo-hypo lesion showing no enhancement, located adjacent to the falciform ligament and without any mass effect.

HCC was diagnosed by the presence of a heterogenous hypodense mass with hyperenhancement in the arterial phase with or without abnormal internal vessels and washout in venous phase Fernandez et al.[8] One case of regenerative nodule in cirrhotic liver and a case of hemangioma were wrongly diagnosed as HCC (false positive).

Cholangiocarcinoma was diagnosed by the presence of a hypodense ill-defined lesion with delayed and prolonged enhancement Evelyn et al.[9]

1HE was identified by the presence of solitary/multiple hypodense lesions with arterial enhancement becoming isodense in the delayed phase.[10] One case was seen and diagnosed correctly using these criteria. Multiple lesions were seen distributed throughout the liver. Associated cutaneous hemangiomas were also seen.

Hepatoblastoma was diagnosed by the presence of a large hypodense lesion with calcification and mixed pattern of enhancement. 55% of cases showed calcification in a study of 50 cases by Abraham et al.[10]

Metastases were diagnosed by the presence of variable density lesions, variable enhancement patterns, and necrosis and h/o malignancy in the patient. Metastases constituted the majority of diagnosis in our study comprising 31% of the overall diagnosis. The most common primary was from colorectal carcinoma (7 cases) followed by metastases from GB (6 cases). The most common enhancement pattern was hypo-hypo-hypo pattern seen in 65% of cases followed by hyper (rim)-hypo-hypo in 17% and mixed-mixed-mixed pattern in 11% of cases. This is similar to the study done by van Leeuwen et al.[6] where hypo-hypo-hypo pattern was most commonly seen in 50% of cases.

Among 31 diagnoses of metastases, 29 were true positives and 2 were false positives. One of the lesions with hypo-hypo-hypo pattern with necrosis on follow-up turned out to be granulomatous (tubercular) lesion. The appearance of this is non-specific and may mimic metastases.[11] Another lesion in a patient with seminoma with hyper-A-A pattern on follow-up turned out to be FNH which was missed due to the absence of the hypodense scar.

CONCLUSION

The accuracy of contrast-enhanced multiphasic CT in detecting and characterizing focal liver lesions is high, and it should be considered in the imaging workup of any patient with focal liver lesions. This helps in guiding further management of these patients avoiding unnecessary investigations and workup for the diagnosis as there is a high incidence of benign pathologies in the liver.

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